GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2021

Subject Code:3132105   **Date:11/09/2021**
Subject Name:Materials Thermodynamics
Time:10:30 AM TO 01:00 PM   **Total Marks:70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Explain Mechanical Equilibrium, Thermal Equilibrium and Chemical Equilibrium.	**03**
	(b)	Explain Isolated system, Closed system and Open system.	**04**
	(c)	Compare Reversible change and Irreversible change.	**07**
Q.2	**(a)**	State significance of 1st law of thermodynamics.	**03**
	(b)	Explain-Energy is state property.	**04**
	(c)	Justify- Cp-Cv = R.	**07**

OR

	(c)	Explain 1st law of thermodynamics and state in it in terms of Enthalpy.	**07**
Q.3	**(a)**	Explain heat capacity.	**03**
	(b)	Calculate the Standard enthalpy change for the reaction: $Cu_2S(s) + 2 Cu_2O(s) = 6Cu (l) + SO_2 (g)$ at 1520K. Given the values of standard enthalpy changes of formation ($\Delta H°_f$) at 1520K in terms of kJ/mol as follows: $Cu_2S(s)$ = -86.5, $Cu_2O(s)$ = -176, Cu (l) = 0, SO_2 (g) = -278.	**04**
	(c)	Explain Kirchhoff's law.	**07**

OR

Q.3	**(a)**	Explain entropy is state and extensive property.	**03**
	(b)	Calculate the standard entropy change for following reaction at 298 K.$Cr_2O_3(s) + 3C(s) + 2Cr(s) + 3CO (g)$. Given $S°_{298,Cr2O3(s)} = 81.18$ J/K/mol, $S°_{298,C(s)} = 5.7$ J/K/mol, $S°_{298,Cr (s)} = 23.75$ J/K/mol, $S°_{298,CO (g)} = 198$ J/K/mol	**04**
	(c)	Explain Hess' Law.	**07**
Q.4	**(a)**	Explain Gibb's free energy is state variable.	**03**
	(b)	Calculate change of free energy of following reduction at 515K. CuO (s) + H_2 (g) = Cu (s) + H_2O (g). Given $\Delta H°_{500}$ = 88 kJ/mol, $\Delta S°_{500}$ = 48 J/K/mol.	**04**
	(c)	Discuss important features of Ellingham diagram.	**07**

OR

Q.4	**(a)**	2ppm means how much percentage.	**03**
	(b)	Derive combined expression of the 1st law and 2nd law of thermodynamics.	**04**
	(c)	Derive Gibb's Phase rule and explain it.	**07**
Q.5	**(a)**	Explain zeroth law of thermodynamics.	**03**
	(b)	Convert atomic % to Weight % for Neodymium based permanent magnet has composition 16% Nd, 76% Fe and 8% B. Given Atomic weight of Nd =144, Fe = 56 and B = 11.	**04**
	(c)	Explain Roult's law and Henry's law	**07**

OR

Q.5	**(a)**	Explain Sievert's law.	**03**
	(b)	Explain phase equilibrium of one component (water) system.	**04**
	(c)	Derive Gibbs-Duhem equation.	**07**